

## **EXECUTIVE SUMMARY**

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### **S.1 SUMMARY**

This summary presents an overview of the Final Environmental Impact Statement (Final EIS) prepared by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) in response to a project proposal from Cedar City. Cedar City has obtained funds through NRCS's small watershed program to reduce flooding risk along Coal Creek where it flows through Cedar City and improve and expand the existing Cedar City parkway.

### **S.2 BACKGROUND**

Coal Creek is a perennial stream with average monthly discharges at the canyon mouth that range from 10 to 20 cubic feet per second (cfs) during 9 months of the year. Average monthly discharges at the canyon mouth range from 60 to 150 cfs during the spring months due to snowmelt in the upper watershed. The peak recorded snowmelt event of 1,820 cfs occurred in May 1973. However, as often occurs in stream systems in arid areas, heavy seasonal thunderstorms can result in flash floods that are much larger than the typical spring snowmelt flood. The U.S. Geological Survey (USGS) has operated a stream gage at the mouth of Cedar Canyon continuously since 1935. During this period, twelve flood events have had a magnitude of at least 2,000 cfs. The largest recorded peak discharge—4,620 cfs—occurred on July 23, 1969. Each of these significant flood events was caused by a cloudburst thunderstorm.

Cedar City, in cooperation with the Natural Resources Conservation Service (NRCS), proposes to modify the Coal Creek channel to safely accommodate runoff from a 100-year flood. New statistical analyses will revise the 100-year discharge used to develop the existing Federal Emergency Management Agency (FEMA) floodplain maps. Proposed channel modifications will allow the 100-year flood to be confined to the Coal Creek channel, thereby protecting surrounding residential and business developments. In conjunction with the proposed channel improvements, two irrigation diversion structures on Coal Creek (the Main Street Diversion and the Woodbury Diversion) will have to be replaced to eliminate significant channel and capacity restrictions created by the existing diversions. It is also proposed to construct sedimentation facilities to remove gravel from water diverted from the Main Street Diversion. Also as part of this project, Cedar City proposes to improve and expand an existing parkway along Coal Creek to enhance aesthetic values and provide recreational opportunities for community residents and visitors.

Any proposal that would require federal action (e.g., partial or total federal funding, federal agency approval, or federal permit issuance) is subject to environmental review and analysis under the National Environmental Policy Act of 1969, as amended (NEPA) before being implemented. To disclose the environmental consequences associated with the flood

control and parkway improvement actions proposed for this project, a Draft Environmental Impact Statement (Draft EIS) was prepared according to NEPA regulations and guidelines. Following public review and comment, a Final EIS (this document) was prepared to not only disclose environmental effects, but is designed to inform the decision-making process.

### **S.3 PROJECT AREA**

For the purposes of analysis in this document, the project area extends along Coal Creek from the old UP&L drop structure, approximately one mile upstream from the mouth of Cedar Canyon, to Airport Road, west of Interstate 15 (4.35 miles).

### **S.4 PURPOSE OF ACTION**

According to the NRCS National Environmental Compliance Handbook Part 610.23 (USDA, NRCS 2003), the Purpose of an action is the goal to be attained, or an end or aim to be kept in view (while meeting an underlying Need). The Purpose of Cedar City's Proposed Action can be summarized as follows:

1. To design and construct flood-control improvements that will allow the Coal Creek channel to safely convey the 100-year flood and reduce associated flooding from the mouth of the Canyon to below I-15.
2. To stabilize the section of Coal Creek that extends from I-15 to the east city boundary to protect existing development and infrastructure, including structures, roads, and bridges.
3. To construct new or modified irrigation diversion structures that will continue to provide entitled water rights to irrigators. These new diversions would reduce sediment deposition in the channel, maintain channel capacity, and, at the Main Street diversion, reduce sediment in diverted irrigation water.
4. To expand the parkway along Coal Creek to connect existing park and trail facilities and provide access to natural resources along the stream and in Cedar Canyon. This parkway includes the maintenance of historic low flows in Coal Creek along the parkway and would add recreational and aesthetic elements, providing a functional, popular, multiple-use amenity for the entire community.

### **S.5 NEED FOR ACTION**

According to the NRCS National Environmental Compliance Handbook Part 610.23 (USDA, NRCS 2003), the project Need is a problem to be solved or an opportunity. For NRCS conservation programs, the Need is usually related to improving the condition of one or more natural resources the program is authorized to address. The Need for Cedar City's Proposed Action includes the following elements:

1. Developed areas in Cedar City need to be protected from flooding events to minimize property damage and the risk to public safety. Seasonal flooding occurs in areas adjacent to the creek and connected irrigation canals. Coal Creek is currently unable to safely convey the 100-year flood.
2. Existing infrastructure (e.g., bridges, roads, utility lines, etc.) needs to be protected from hazards related to lateral bank erosion.
3. There is strong local demand for recreational opportunities along Coal Creek.

## **S.6 REGULATORY AUTHORITY AND DECISIONS TO BE MADE**

Although Cedar City and its citizens are the developers and benefactors of the Proposed Actions discussed above, the NRCS maintains the responsibility of making the final decision on the administration of funds for the actions. In this case, the role of the NRCS includes:

- Overseeing the NEPA process and analysis from start to finish.
- Designating cooperating, contributing, and/or coordinating agencies.
- Ensuring that agency consultation occurs.
- Providing public involvement opportunities.
- Selecting the preferred alternative and making the final decision on the federal action or disbursement of funds.

## **S.7 ISSUES**

To satisfy the requirements of NEPA for public involvement in the current project, the public was invited to comment on the proposed project. The public comment period was initiated on February 11, 2005 with publication of the Notice of Intent (NOI) in the Federal Register. The NOI outlined the NRCS's plan to prepare an EIS for Cedar City's Proposed Action regarding the Coal Creek channel and watershed.

One public meeting was held by the NRCS on March 10, 2005, at the Cedar City public library. Approximately 140 citizens of Cedar City and surrounding communities attended the meeting. In addition to the public meeting, the public was invited to submit comments until March 21, 2005, which marked the close of the comment period. During this time, comments were accepted in a variety of formats, including email, project web page, and regular mail. The public meeting and the 38-day comment period resulted in 34 individual letters and a total of 105 unique comments. The significant issues identified during the comment period were used throughout the course of the alternative-development and analysis phases of the NEPA process. The major issues identified during the initial comment period are summarized below.

### **S.7.1 CULTURAL RESOURCES**

It was suggested that impacts to cultural resources such as the Civilian Conservation Corps (CCC) dams near the mouth of Cedar Canyon be avoided.

### **S.7.2 FLOODPLAIN**

Citizens were concerned that the flood control actions described do not extend far enough downstream and asked that the project area be extended to include areas west of I-15. It was also suggested that the buffer width between Coal Creek and any development be expanded to ensure that flood-related hazards will not threaten future buildings.

### **S.7.3 GROUNDWATER**

Many citizens were concerned that the project would have a negative impact on groundwater, specifically aquifer recharge and the wells in the valley.

### **S.7.4 IRRIGATION**

Although this is not an irrigation project, there were a considerable number of comments concerning the impact of the project on irrigation. Many felt that any chosen alternative needed to support the irrigators in the valley, and that this project could be an opportunity for future irrigation development. It was also frequently noted that existing water rights need to be honored and respected.

### **S.7.5 PARKWAY**

Although most citizens were in support of developing a parkway along Coal Creek, many were concerned about the impact on adjacent property owners. Many citizens in favor of the parkway would like trails to complement what is already there. Some suggested the trail should go under the Main Street Bridge, while others were opposed to this route for safety reasons.

### **S.7.6 PROCESS**

Many citizens were concerned about the funding of the project and whether their taxes would increase due to project implementation. Others commented on the NEPA process, questioning the ability of the City to make decisions without putting it to vote. Still others looked at this project as an opportunity to work together, plan for the future, and balance the rights and interests of all involved. It was suggested that collaboration with other municipalities and the county would make this project more successful. In addition, many believed there is a need to educate the community and directly involve community citizens in the decision-making process.

### **S.7.7 RECREATION AND VISUAL RESOURCES**

Most community citizens were in support of development of the parkway for recreational and aesthetic reasons but wanted to make sure that any alternative put forward for analysis allowed their current recreational opportunities to continue.

### **S.7.8 SOCIOECONOMICS**

Community members felt that it was important for the City to choose an alternative that would be the least expensive and promote tourism.

### **S.7.9 VEGETATION**

Citizens who were concerned that taking water out of the Coal Creek stream will negatively impact riparian resources along the creek bed emphasized that minimum flow needs to be maintained. It was also suggested that restoration and maintenance of the creek should include native soils and stones, as opposed to concrete and other non-natural building materials.

### **S.7.10 WATER FLOW**

Many community citizens were concerned that water flow in Coal Creek would be reduced and wanted an alternative that would maintain, or nearly maintain, water flow in Coal Creek.

### **S.7.11 WATER QUALITY**

Community citizens do not want their water quality threatened in any way.

### **S.7.12 WILDLIFE**

Community citizens wanted to make sure that the impacts of any alternatives on wildlife, specifically threatened or endangered species were considered. It was suggested that, when implementing the project, the City should seek to establish riparian and stream channel habitats that are suitable for native wildlife species.

## **S.8 ALTERNATIVES**

This section describes three alternatives: A (the No Action Alternative), B (Relocate Main Street Diversion), and C (Replace Main Street Diversion). As defined in NEPA, the development of alternatives is a necessary part of the environmental impacts analysis process. According to CEQ regulations for implementing NEPA, the NEPA process should:

present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public (40 CFR § 1502.14).

This includes consideration of a "range of alternatives" (40 CFR § 1505.1(e)). This range must include only reasonable alternatives, meaning those alternatives that are both technologically practical and economically viable. The purpose of developing a range of alternative actions is to meet the purpose and need of the project while addressing issues and concerns expressed during the public scoping process.

### ***S.8.1 ALTERNATIVE A: NO ACTION***

The No Action Alternative proposes to continue channel sediment maintenance and stream-bank armoring activities as they are currently managed. The Main Street diversion/drop structure would remain in its current location and continue in its present state to serve existing irrigators. Sediment under the Main Street Bridge would continue to be dredged by UDOT as it has in the past. There would be no modifications to the channel cross section or gradient. The 100- and 500-year floodplains as depicted on current FEMA floodplain maps would remain as they are (Figure 2.1). The parkway that extends from the old UP&L drop structure down to the sports fields near 200 East would remain in its current state, with no additional trails connecting to the Bicentennial Park or west of I-15.

### ***S.8.2 ELEMENTS COMMON TO THE ACTION ALTERNATIVES B AND C***

Both of the action alternatives share several common elements. To avoid unnecessary repetition in this document, they are discussed below. The fundamental difference between the action alternatives is the location of the Main Street diversion structure and the associated pipe required to return irrigation water to the existing canal heads. The action alternatives and options discussed in the following sections are conceptual in nature. While final engineering design may change the exact placement, orientation, or size of some of the structures, the overall impact footprint should remain relatively consistent. The schematic designs and their associated footprints may slightly overestimate potential impacts. This was done to minimize the chance for undisclosed impacts as designs are later refined.

#### ***S.8.2.1 PARKWAY***

The parkway alignment presented in this document is conceptual, and several assumptions are used for purposes of analysis. The proposed parkway and trail alignment would be the same for both action alternatives (Figures 2.3 and 2.4) except for minor differences where the parkway crosses Main Street. These parkway connection options are described in Sections 2.4.3 and 2.4.4 and are analyzed with the alternatives in each resource section of Chapter 3. The parkway would vary in width along the corridor, but an average width of 25 feet.

#### **S.8.2.2 SUB-REACH A (UP&L DROP STRUCTURE TO CENTER STREET BRIDGE)**

The action alternatives would stabilize actively eroding areas near existing utilities, roads, trails, and other existing infrastructure. Potential areas that may be stabilized are identified in Figure 2.3.

#### **S.8.2.3 SUB-REACH B (CENTER STREET BRIDGE TO 200 EAST BRIDGE)**

Actively eroding areas in this sub-reach would be stabilized. Potential areas are identified in Figure 2.3.

Both action alternatives would modify the channel cross sections to be narrower where lateral channel migration has made the channel significantly wider than adjacent channel reaches. Channel cross sections in the vicinity of the historic pedestrian bridge would be widened. Typical cross sections are identified in Figure 2.2.

#### **S.8.2.4 SUB-REACH C (200 EAST BRIDGE TO MAIN STREET DIVERSION/DROP STRUCTURE)**

This sub-reach contains the Main Street Diversion, which would be demolished and reconstructed in one of two locations (detailed in Alternatives B and C). The channel in this sub-reach would need to be widened and deepened to increase the channel slope from the existing Main Street Diversion structure to a point approximately 2,000 feet upstream. Typical cross sections are shown in Figure 2.2.

#### **S.8.2.5 SUB-REACH D (MAIN STREET DIVERSION/DROP STRUCTURE TO WOODBURY DIVERSION STRUCTURE)**

The Woodbury Diversion in this sub-reach would be reconstructed to be wider. The structure's downstream elevation drop would be reduced to 2-3 feet. Channel constrictions in this sub-reach would need to be alleviated by widening and deepening the channel (increasing channel slope to approximately 1.5%) from the existing Woodbury Diversion structure to a point approximately 3,000 feet upstream. A typical cross section is identified in Figure 2.2. The section of the channel with the vertical banks, just below the Main Street Diversion, would be stabilized.

Flood control levees would be constructed to provide needed channel capacity and free-board in the areas shown in Figure 2.4. It would also be necessary to deepen a section of the Quichapa Channel for several hundred feet between Coal Creek and I-15. This action may also require the replacement of the Coal Creek Bridge that spans the Quichapa Channel.

#### **S.8.2.6 SUB-REACH E (WOODBURY DIVERSION STRUCTURE TO I-15)**

To ensure that the recommended channel cross section and slope are maintained through this sub-reach, short levees or structural fill would be placed in low areas adjacent to the existing channel, primarily between the 1045 North Bridge and I-15 (Figure 2.4).

### **S.8.2.7 SUB-REACH F (I-15 TO AIRPORT ROAD)**

If channel improvements are implemented in this sub-reach as part of this project, they would include constructing flood control levees on both sides of the channel and constructing a channel with a fairly uniform cross section and slope (Figure 2.2).

### **S.8.3 ALTERNATIVE B: RELOCATE MAIN STREET DIVERSION**

In addition to the common elements described in Section 2.4.2, Alternative B proposes to demolish and remove the existing Main Street Diversion structure and reconstruct a new diversion/drop structure approximately 1,600 feet upstream. This would require dropping the channel invert at the existing diversion structure location 6–10 feet and constructing a channel with an approximate bottom width of 50 feet, 2:1 side slopes, and a 1.9% channel slope from the existing structure location to a point approximately 1,600 feet upstream. The new structure would be approximately 50 feet wide to match upstream and downstream cross sections (Figure 2.2).

Figure 2.5 illustrates the infrastructure improvements associated with the relocated diversion structure. A large sedimentation basin would be constructed northeast of the creek above 100 East to remove gravel from irrigation water diverted from the creek. This basin would have the capacity to function properly under a design flow of 100 cfs. It would be approximately 175 feet long and 10 feet wide.

Finally, pipelines of varying diameters would be installed to convey diverted water from the sedimentation basin to existing canal heads. Approximately 1,600 linear feet of 42-inch pipeline would be needed to convey water from the sedimentation basin to an upper diversion structure (i.e., "Old Fort," which is adjacent to the original Main Street Diversion).

Water from the Old Fort diversion would be conveyed to a lower diversion structure and would be distributed to the three existing canals or ditches on the north side of the creek, with a pipe to each. Approximately 150 linear feet of 30-inch pipeline would convey water to the Union Field Canal. Approximately 150 linear feet of 36-inch pipeline would be used to convey water to the North Field/East Extension. Approximately 150 linear feet of 30-inch pipeline would convey water from the lower diversion structure to a point where the water could be returned to the Northwest Fields ditch. Each of these pipelines would be buried in the existing canal rights-of-way (ROWs).

In high-flow situations, water would also be diverted from the Old Fields diversion into the Old Fort/Old Fields ditch to the south, near the intersection of Coal Creek Road and 100 West Street. Approximately 1,200 linear feet of 21-inch pipe would be used to convey water from the Old Fort diversion structure to the point where it can be returned to the existing Old Fort/Old Fields pipeline; this pipe would be constructed in the same location as the existing pipeline. It would, however, be deeper.

A sluice pipeline would be constructed to convey sediment that settled out in the sedimentation basin back into the main channel. Additionally, a low-flow wastage would be used to discharge low flows back into the creek immediately below the diversion structure, which would allow the diversion structure to remain clear of sediment during periods when no irrigation water is being diverted.

#### **S.8.3.1 PARKWAY OPTION B1**

Parkway Option B1 would develop/enhance the existing crosswalk at the Main Street Bridge to connect parkway trails (Figure 2.4). This option would require potential property or easement acquisition along the south side of the creek in the vicinity of the Main Street Bridge.

#### **S.8.3.2 PARKWAY OPTION B2**

Parkway Option B2 would develop/enhance trail using existing city sidewalks and ROWs. The trail would cross to the south side of the creek at a proposed 400 North pedestrian bridge, then follow the 400 North ROW to Main Street. The route would go north along the east side of Main Street to the Coal Creek crossing and use the street crosswalk to access the trail on the west side of the road (Figure 2.4). This option would not require property or easement acquisition.

### ***S.8.4 ALTERNATIVE C: REPLACE MAIN STREET DIVERSION***

In addition to the common elements described in Sections S.8.2 and 2.4.2, Alternative C proposes to construct a new diversion/drop structure where the existing Main Street Diversion structure is located. This would entail dropping the channel invert at the existing diversion structure approximately 4 feet and constructing a channel with an approximate bottom width of 50 feet, 2:1 side slopes, and a 1.9% channel slope from the existing structure location approximately 1,500 feet upstream. The modified diversion structure would be approximately 50 feet wide to match upstream and downstream sections (Figure 2.2).

Figure 2.5 illustrates the proposed infrastructure improvements that would be associated with replacing the existing Main Street diversion structure. A large sedimentation basin north of the creek would be used to remove gravel from irrigation water diverted from the creek. This basin would have the capacity to function properly under a design flow of 90 cfs. It would be approximately 150 feet long and 40 feet wide.

Another small sedimentation basin, south of the creek, would be constructed to remove gravel from irrigation water being diverted into the Old Fort/Old Fields ditch. The basin would be approximately 50 feet long and 10 feet wide. Approximately 1,200 linear feet of 20-inch pipe would convey water from this small sedimentation basin to a point where it could be returned to the existing Old Fort/Old Fields pipeline near the intersection of Coal Creek Road and 300 West Street. This pipeline would be constructed in the same location as the existing pipeline. It would, however, be deeper.

Sluice pipelines would be constructed to convey sediment that settled out in the sedimentation basins back into the main channel. A low-flow wasteway would be used to discharge low flows back into the creek immediately below the diversion structure, which would allow the diversion structure to remain clear of sediment during periods when no irrigation water is being diverted.

Approximately 2,100 linear feet of 36-inch pipeline would be constructed to convey water from the large sedimentation basin to a point where water could be returned to the Union Field Canal. The pipe would be buried in the existing canal ROW.

A 30-inch pipeline would convey water 700 linear feet from the sedimentation basin to the North Field/East Extension. Another 900-foot section of 24-inch pipe would be constructed to convey water from the sedimentation basin to the Northwest Fields ditch canal. As with the other pipelines, these pipelines would be buried in the existing canal ROW.

The pedestrian truss bridge located just upstream of the 200 East Bridge does not provide sufficient freeboard to safely convey the 100-year flood. To address this capacity deficiency, the truss bridge would be removed to alleviate the channel constriction in this area.

#### **S.8.4.1 NORTHFIELD CANAL OPTION**

This option proposes to use one pipe instead of three pipes to convey irrigation water from the sediment basin to the existing irrigation system (Figure 2.6). This option would require approximately 3,300 linear feet of 42-inch pressure piping along the existing North Field/East Extension Canal alignment from the sedimentation basin to 1045 North. Due to the high sediment load and high variation in design flows for this pipeline, pipe cleaning must be accommodated with inclusion of a "pig launcher" near the diversion structure to allow a pipe cleaning swab, or "pig", to be sent down the pipe seasonally to remove any accumulated silt or debris that settled out during the previous irrigation season.

A flow measurement and control structure will be required at 1045 North where the pressure pipe will branch and distribute flow to the respective existing irrigation canals. An additional 800 feet of 24-inch pressure pipe will be constructed from the new 1045 North diversion structure to the existing Union Field canal near Main Street, and an additional 1,500 feet of 24-inch gravity or low pressure pipe will be required from the new 1045 North diversion structure to distribute flow to the existing North West Field Canal near North Cedar Boulevard. Finally, 700 feet of a 24-inch gravity overflow and drain pipe will be extended west along 1045 North from the North West Field Canal connection to Coal Creek to allow for seasonal draining and maintenance of the pipeline and canals.

### **S.8.4.2 PARKWAY OPTION C1**

Parkway Option C1 would route parkway pedestrian movement across Main Street by providing an underpass on the north side of the creek at the Main Street Bridge: in this case, a concrete path under the Main Street Bridge that would be elevated several feet above the channel invert. This option would require potential property or easement acquisition along the north side of the creek in the vicinity of the Main Street Bridge.

### **S.8.4.3 PARKWAY OPTION C2**

Parkway Option C2 would connect the east and west parkway trails via a large box culvert constructed underneath Main Street (parallel, but not adjacent to the creek) on the north side of the creek. The culvert would be dedicated to pedestrian use. This option would require potential property or easement acquisition on the north side of the creek near the Main Street Bridge.

## **S.9 ALTERNATIVES ELIMINATED FROM DETAILED ANALYSIS**

Alternatives that do not meet the purpose and need of the project, do not resolve resource conflicts, or are not practicable are dismissed from detailed study. A brief discussion of these alternatives and why they were eliminated from detailed analysis is given below.

### ***S.9.1 DUAL CHANNELS***

This alternative entailed the construction of an additional channel parallel to the existing Coal Creek channel for the purpose of conveying a 100-year flood. The NRCS deemed this an untenable alternative, due to the fact that there is insufficient space adjacent to the existing channel to accommodate a new channel with sufficient capacity to convey a 100-year flood. The Coal Creek channel traverses through an urbanized portion of Cedar City. Existing development exists adjacent to much of the existing Coal Creek Channel the project area. Some structures are located less than 50 feet away from the channel bank. There are no open corridors available to construct a second channel parallel to the existing Coal Creek Channel and the existing channel corridor lacks space to improve the existing channel in some areas. Constructing a parallel channel would require extensive property acquisition, demolition of existing structures, construction of new bridges, and relocation of existing utilities. Constructing a parallel channel would also disturb more land and increase the area that would have to be maintained. For these reasons, this option was considered to be economically infeasible and environmentally and socially undesirable.

### ***S.9.2 PEDESTRIAN UNDERPASS USED AS FLOOD DIVERSION***

This alternative was proposed to increase channel capacity at the Main Street Bridge and to provide a connective pedestrian link across Main Street. The alternative was eliminated from further analysis, as it did not address the fundamental issues of channel constriction

and gradient that contribute to ongoing sedimentation and subsequent loss of channel capacity in this area. An enclosed pedestrian pathway under the bridge would present another potential constriction under the bridge, in that it would not let large debris (e.g., uprooted trees) pass under the bridge. Additionally, a pedestrian pathway would be inundated during high flow, preventing full use of the proposed parkway and presenting public safety issues.

### ***S.9.3 PARKWAY FOR FLOOD CONVEYANCE***

This alternative proposed that the constructed parkway be used to augment the capacity of the channel to convey a 100-year flood. This alternative was dismissed from detailed analysis because existing and proposed City facilities and infrastructure would be put at risk of flood-related damage and loss. The parkway represents a significant community investment. Adding flooding risk to developed areas outside of the creek channel runs counter to the Purpose of and Need for the project and would add to the market value costs that must be evaluated in determining the benefit-cost ratio (see Section 3.12) for the project.

### ***S.9.4 DIVERSION DIKES/WALLS***

This alternative proposed the construction of dikes and walls to keep floodwaters in the channel. Though some dikes are being proposed as part of the action alternatives, this alternative was eliminated from further consideration, as it did not address existing channel constrictions and gradient issues that impact channel capacity and sedimentation. Building dikes and levees to increase channel capacity will not prevent the accumulation of sediment at the Main Street Diversion or the reduction in flow capacity at the Main Street Bridge.

### ***S.9.5 STORAGE PONDS TO CAPTURE WATER***

To handle large volumes of floodwater and benefit area wells and aquifers, it was proposed that groundwater recharge "ponds" be constructed in the valley to capture floodwaters and recharge the groundwater. Also proposed was a variation on this alternative: to divert flood waters into the gravel pits west of I-15 for the same purpose. In fact during spring flooding of 2005, some water was diverted and contained in these areas.

This alternative was eliminated from further consideration because it does not address channel capacity deficiencies and because of the high level of suspended fine sediments in the water (clay and small silt particles) that would effectively plug infiltration/recharge areas, necessitating constant maintenance. Additionally, the size of the ponds that would be required to store the projected floodwaters would be so large that their construction would result in large impacts to existing lands and/or habitat in the project area.

### ***S.9.6 OFF-STREAM STORAGE RESERVOIR***

This proposal involves constructing a diversion structure at Coal Creek in Cedar Canyon with an associated gravity flow pipeline to an off-stream, water storage/reservoir structure. An additional gravity flow pipeline from the dam site to a water treatment plant would also be constructed, if desired, and a gravity flow pressurized pipeline would be built in the existing UDOT ROW. The entire reservoir and the dam would be built on public lands.

The purpose for this alternative is primarily to serve irrigation needs and not flood control. Thus, this alternative was eliminated from further consideration because it did not meet Purpose and Need as expressed in Chapter 1 and because of the resource conflict caused by dewatering Coal Creek through a portion of Cedar Canyon and where it passes through the City. This alternative also has the risk of negatively impacting groundwater recharge and well water rights downstream.

### ***S.9.7 HIGH-FLOW DIVERSION***

This alternative sought to maintain at least 150 cfs flow in the existing channel during high-flow events. When flows exceed 150 cfs, the excess water would be diverted out of the channel. This alternative was eliminated from further analysis for the same reasons identified under Sections 2.3.1 and 2.3.3. Given existing development, there is not sufficient room to safely accommodate floodwater outside of the channel.

### ***S.9.8. EXTEND PROJECT WEST OF I-15***

This alternative proposed to continue the flood control improvements west of I-15 and into the valley. This alternative was eliminated from detailed analysis because the legislative appropriation for this project was secured to address flood control concerns only within the City and, more specifically, for improvements east of I-15. Accordingly, this use of appropriated funds is not authorized, and currently there are not adequate funds to implement long-term channel modifications or improvements west of I-15.

It should be noted that Iron County is currently in the process of applying for federal aid to address similar concerns west of I-15. It should also be noted that the Proposed Action would be completed regardless of any actions taken by the County. Though the County is attempting to obtain additional funding, such funding and any subsequent flood control activities are considered speculative, given the unpredictable nature of federal funding. Potential downstream (indirect and cumulative) impacts of flooding west of I-15 are disclosed in this document (see Section 3.13).

### ***S.9.9 FLOOD CONTROL WITHOUT ALTERING STREAM***

The advocate of this alternative did not provide sufficient detail for analysis of this alternative. However, similar to other alternatives discussed in this section, there are some fundamental hydrologic issues that need to be resolved within the channel itself so that it is able to safely convey a 100-year flood. Failure to address the deficiencies of the existing channel does not meet the Purpose and Need for the project. Needed channel modifications include: widening narrow channel sections, narrowing wide channel sections, constructing levees on banks with inadequate freeboard, increasing the channel gradient to improve flood conveyance capacity and reduce sediment deposition, and armoring the channel to reduce erosion hazards. The most feasible methods to accomplish the flood control objectives must include alterations to the creek channel. For these reasons, the alternative was considered untenable and dismissed from further analysis.

### ***S.9.10 RESTORE AND MAINTAIN A SINUOUS CHANNEL***

The idea to develop a sinuous and natural-looking channel was proposed as a project goal. While desirable in an aesthetic sense, such channels do not typically accommodate a 100-year flood event (the primary Purpose and Need in this EIS). Fluvial systems like Coal Creek tend to actively migrate across the alluvial plain that has developed through centuries of deposition from sediment-laden streams. High-volume events quickly change or destroy sinuous channels. In order for a sinuous channel to accommodate flood flows, it needs to have a wide, active floodplain. It may have been possible to implement an alternative like this 100 years ago, before Cedar City had encroached into the Coal Creek floodplain. Presently, urban development is too close to the stream to allow for reconstruction of a meandering channel with an active floodplain.

### ***S.9.11 RELOCATE DIVERSION POINT INTO CEDAR CANYON***

This alternative was presented at the open-house public meeting held March 10, 2005. It proposed relocating the Main Street Diversion upstream into the canyon to one of three potential sites.

This alternative was eliminated from further consideration, as its reason was not to meet the Purpose and Need of the project or to resolve specific resource conflicts, but to develop pressurized irrigation capability. In addition, the alternative was eliminated because of the resource conflict caused by dewatering Coal Creek through a portion of Cedar Canyon and where it passes through the City.

### **S.9.12 PUMPING STATION AT 200 EAST**

The purpose for installing a pumping station at this location would be to provide pressurized water for irrigation. This alternative was eliminated from further consideration, as its reason was not to meet the Purpose and Need of the project or to resolve specific resource conflicts, but to develop pressurized irrigation capability. Such an alternative is beyond the scope and budget for this project.

### **S.9.13 COAL CREEK BUFFER ZONE TO LIMIT DEVELOPMENT**

This is a common-sense approach to limiting property damage in the 100- and 500-year floodplains for future development in these areas. Unfortunately, there is currently substantial commercial, industrial, and residential development in these floodplains that would be impacted by implementation of this alternative; therefore, this alternative is not feasible. It was eliminated from further consideration, as it did not meet the Purpose of and Need for the project to reduce the FEMA floodplain and reduce impacts to existing development in the existing FEMA floodplain.

### **S.9.14 VEGETATION TO STABILIZE STREAMBANKS**

Using vegetation to help stabilize streambanks is an action that is frequently recommended as mitigation for ground-disturbing activities (see Chapter 3). However, this action alone does not meet the Purpose of and Need for the project to increase the flow capacity of the channel, and thereby reduce flood-related impacts in the community.

## **S.10 AFFECTED ENVIRONMENT**

### **S.10.1 AIR QUALITY**

The Utah Air Quality Monitoring Center conducted monitoring for PM<sub>10</sub> particulates in Cedar City from 1994 through 1997. The data collected were reported as annual mean of 24-hour average concentrations and second highest 24-hour average concentrations. The annual mean of 24-hour average concentration data showed concentrations of 22, 19, 18, and 18  $\mu\text{g}/\text{m}^3$  for 1994, 1995, 1996, and 1997, respectively. The air quality standard for annual mean of 24-hour average PM<sub>10</sub> particulate concentration is 50  $\mu\text{g}/\text{m}^3$ . All of the reported concentrations are less than 50% of the air quality standard and show no exceedance of the criteria (EPA 2005a, 2005b).

The second highest 24-hour average concentration data showed concentrations of 60, 34, 38, and 31  $\mu\text{g}/\text{m}^3$  for 1994, 1995, 1996, and 1997, respectively. The air quality standard for 24-hour average concentration PM<sub>10</sub> particulates is 150  $\mu\text{g}/\text{m}^3$  (not to be exceeded more than once per year after compensating for days when monitoring did not occur). All of the reported concentrations in the project area are less than 50% of the air quality standard and show no exceedance of the criteria (EPA 2005a, 2005b).

No additional parameters were monitored/reported from 1994 through 1997. No consistent air quality monitoring specific to the project area is available after 1997 (personal communication with K. Symons, UDAQ, May 2005). The project area is located in an area designated as attainment or unclassified for all pollutants (personal communication with K. Symons, UDAQ, May 2005; EPA 2005a).

Background concentration for potential CO emissions from construction equipment and vehicles information was not available. The applicable NAAQS for CO is 40,000  $\mu\text{g}/\text{m}^3$ . Background concentration information for potential NO<sub>2</sub> concentrations is not available. The applicable NAAQS for NO<sub>2</sub> concentrations is 100  $\mu\text{g}/\text{m}^3$  (annual).

No Class I areas are located within or adjacent to the project area. Zion National Park, at a distance of approximately 20 linear miles, and Bryce Canyon National Park, at a distance of approximately 50 linear miles, are the Class I areas located nearest the project area. Due to linear distances and dominant wind directions, pollutant transport and dispersion patterns within and adjacent to the project area will not likely transport pollutants into or near Zion or Bryce Canyon National Park (EPA 1999, 2001, 2003a, and 2003b).

### **S.10.2 SOILS AND GEOLOGY**

The aspects of geology that most directly influence flood flows and sediment dynamics in Coal Creek are the erosivity of bedrock units and their historical movement along the Hurricane Fault. The majority of the rocks in the Coal Creek watershed are sedimentary in origin. These rocks formed under a variety of conditions and include sandstones, siltstones, mudstones, and limestones. Some rock units also contain layers of gypsum, which influences water quality. The following table (Table S.1) contains descriptions and thicknesses of rock units in the project area. In terms of this project, the most important characteristic of many of these units is that they are highly erodible sedimentary rocks.

Soils within the project area are formed primarily in Quaternary alluvial sediments derived from the Coal Creek watershed. Therefore, within the project area, soils are generally deep to very deep (40 to more than 60 inches soil depth), with the exception of soils up the Cedar Canyon, near canyon walls, that have a depth to bedrock as shallow as 10 inches. Project area soils receive approximately 12–16 inches of precipitation annually (xeric soil moisture regime) and range in temperature from 45 to 52°F (mesic soil temperature regime).

Approximately 51.0 acres of soils within the project area are susceptible to water erosion. Soils with high susceptibility to wind erosion do not occur within the project area. Approximately 9.9 acres of project area soils are moderately susceptible to wind erosion, and approximately 51.8 acres are slightly susceptible to wind erosion. Unfortunately, the majority of soils susceptible to soil erosion are situated along the Coal Creek stream channel.

**Table S.1.** General Stratigraphy of Rock Units Within the Coal Creek Watershed, Adapted from Hintze (1998), Averitt (1962), and Bjorklund and Others (1978)

	<b>Geologic Formation</b>	<b>Description</b>	<b>Thickness (feet)</b>
Quaternary	Alluvium	Gravel, sand, silt, and clay.	0-3,000+
	Alluvial-fan deposits	Poorly sorted gravel, sand, silt and clay; gradational with Quaternary alluvium.	Variable depth
Tertiary	Volcanic rocks	Basalt, rhyolite, and tuffs.	Variable depth
	Claron Formation	Thin- to thick-bedded sandstone, shale, and limestone.	Variable depth
	Grand Castle Formation	Interbedded sandstone and conglomerate.	Variable depth
Cretaceous	Iron Springs Formation	Thin-bedded to massive sandstone with some carbonaceous shale and coal with some conglomerate beds and shale at base.	Variable depth
	Wahweap and Straight Cliffs Sandstones	Fine grained sandstone and siltstone containing some coal and organic rich fossiliferous seams.	600-1,200
	Tropic Shale	Shale.	700-800
	Dakota Formation	Shale with some sandstone.	400-600
Jurassic	Carmel Formation	Thin-bedded shaley limestone, sandstone, siltstone, mudstone with gypsum, or massive gypsum beds with sandstone and mudstone.	550-1,300
	Navajo Sandstone	Medium-grained sandstone with large-scale cross-bedding and minor limestone deposits.	1,600-2,000
	Kayenta Formation	Mudstone and silty mudstone.	Variable depth
	Moenave Formation	Siltstone and mudstone overlain by massive sandstone with cross-bedding.	Variable depth
	Chinle Formation	Basal conglomerate overlain by mudstone and siltstone.	300-500
Triassic	Moenkopi Formation	Siltstone and mudstone.	1,600-1,800

Gypsum-bearing soils are usually structurally stable when they receive precipitation consistent with their location (e.g., 12–16 inches per annum). However, problems may arise when gypsum-bearing soils are irrigated excessively. Soils that lose gypsum can deflate, resulting in ground subsidence. The Coal Creek project area contains one soil mapping unit, Map

Unit 310 (Ashdown loam, gypsiferous substratum, 2–5% slopes), with a high gypsum content. This soil is located along Coal Creek between the mouth of Cedar Canyon and Main Street and comprises 6.4 acres of the project area.

### **S.10.3 SURFACE AND GROUNDWATER RESOURCES**

The primary use of water in the Coal Creek drainage is irrigation (agricultural and residential/municipal), with approximately 44,000 acre-feet utilized on an annual basis (42% from surface water and 58% from groundwater supplies). Agricultural irrigation diversions are present on every river and stream in the Cedar Valley area. Although surface waters in the area were used historically for culinary water supplies, wells and springs (piped) are now used, almost exclusively.

The UDEQ and USGS conducted water chemistry monitoring programs near the USGS gage site on Coal Creek from 1980 through 1997 (EPA 2005). Water quality parameters collected include alkalinity, total dissolved solids (TDS), specific conductance, total suspended solids (TSS), turbidity, dissolved oxygen (DO), pH, and water temperature and flow. The State of Utah has identified the designated beneficial uses for Coal Creek as:

- Secondary contact recreation;
- Cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain; and
- Agricultural water supply including irrigation of crops and stock watering (Utah State Code R317-2-13.6a).

Water quality standards for DO, water temperature, pH, turbidity, and TDS, specific to the support and protection of these designated uses, have been identified by the state as contained in Tables 2.14.1 and 2.14.2 of the Utah State Code R317-2-13 (March 2005). With the exception of pH and water temperature, the available data show no exceedances of the identified criteria.

Exceedances of the pH criteria (pH less than 6.5 or greater than 9.0) occurred approximately 1% of the time in the available dataset (i.e., one data point) and were not indicative of beneficial use impairment. Exceedances of the water temperature criteria (no greater than 20 C) occurred approximately 6% of the time in the available dataset (i.e., six data points, all observed during summer months).

A recent survey of groundwater quality by USGS (1998) stated that recent groundwater data collected by the Utah Division of Water Resources (UDWaR), the UDEQ, and the USGS indicate the presence of high TDS and nitrate concentrations in some wells. TDS concentrations in Cedar Valley groundwater were observed to vary between 158 and 2,752 mg/L. Available concentration data range from less than 0.06 mg/L to 57.40 mg/L. Wells with elevated nitrate concentrations were observed to be distributed throughout the valley, although high-nitrate wells are more common near the Hurricane fault on the east side of the valley (Eisinger 1998).

### S.10.4 VEGETATION RESOURCES

A site visit was conducted in April 2005 to catalog plant species present in the project area. Within the project area, vegetation communities observed include:

- Disturbed sagebrush/perennial grass
- Mountain shrub
- Undesirable plant species and noxious weeds
- Riparian areas and wetlands

Descriptions of disturbed sagebrush/perennial grass, mountain shrub, and undesirable and noxious weed plant communities, as well as general locations of these communities within the project area, are provided below.

#### S.10.4.1 DISTURBED SAGEBRUSH/PERENNIAL GRASS

This community, commonly found in urban environments, is located primarily in sub-reaches C-F (200 East Bridge to Airport Road) of the current project area (Figure 3.8). This plant community includes sparse shrubs and weedy species such as cheatgrass, flixweed, and curve seed butterwort (Table S.2).

**Table S.2.** Common Species Observed in the Disturbed Sagebrush/Perennial Grass Community

Scientific Name	Common Name
<b>Shrubs</b>	
<i>Artemisia tridentata</i> spp. <i>tridentata</i>	Basin big sagebrush
<i>Chrysothamnus viscidiflorus</i>	Yellow rabbitbrush
<b>Grasses and Forbs</b>	
<i>Bromus tectorum</i>	Cheatgrass
<i>Carduus nutans</i>	Musk thistle
<i>Ceratocephala testiculata</i>	Curve seed butterwort
<i>Chorispora tenella</i>	Blue mustard
<i>Descurania sophia</i>	Flixweed
<i>Elymus repens</i>	Quackgrass
<i>Erodium cicutarium</i>	Redstem stork's bill
<i>Salsola tragus</i>	Prickly Russian thistle

Plant names are from the NRCS Plants Database 2005.

### S.10.4.2 MOUNTAIN SHRUB

The mountain shrub community is primarily located in sub-reaches A and B (UP&L drop structure to 200 East Bridge) of the project area (see Figure 3.8). This association is sometimes called browse, because a large proportion of the species in this association are of high forage and cover value for wildlife (Table S.3). The sagebrush may occasionally grow densely in areas, but generally, it is less than 50% of the overall composition in this community. Many forbs also occur in this area and are an important resource for sage grouse (Edwards et al. 1994).

**Table S.3.** Common Species Observed in the Mountain Shrub Community

Scientific Name	Common Name
<b>Trees</b>	
<i>Juniperus osteosperma</i>	Utah juniper
<i>Pinus edulis</i>	Two needle pinyon
<b>Shrubs</b>	
<i>Amelanchier utahensis</i>	Utah serviceberry
<i>Artemisia tridentata</i> spp. <i>tridentata</i>	Basin big sagebrush
<i>Atriplex canescens</i>	Four-wing saltbush
<i>Cercocarpus ledifolius</i>	Curly leaf mountain mahogany
<i>Chrysothamnus viscidiflorus</i>	Yellow rabbitbrush
<i>Fallugia paradoxa</i>	Apache plume
<i>Fraxinus anomala</i>	Singleleaf ash
<i>Purshia tridentata</i>	Bitterbrush
<b>Grasses and Forbs</b>	
<i>Achnatherum hymenoides</i>	Indian ricegrass
<i>Chorispora tenella</i>	Blue mustard
<i>Elymus canadensis</i>	Wild rye
<i>Gutierrezia sarothrae</i>	Broom snakeweed
<i>Hesperostipa comata</i>	Needle and thread grass
<i>Hordeum leporinum</i>	Hare barley
<i>Leptodactylon pungens</i>	Shrubby phlox
<i>Pascopyrum smithii</i>	Western wheatgrass
<i>Pseudoroegneria spicata</i>	Bluebunch wheatgrass
<i>Yucca filamentosa</i>	Yucca

Plant names are from the NRCS Plants Database 2005.

### S.10.4.3 RIPARIAN AND WETLAND SPECIES

Common plant species in this association are shown in Table S.4. Further discussion of wetland and riparian areas is in Section S.4.

**Table S.4.** Common Species Observed in the Riparian and Wetland Communities

Scientific Name	Common Name
<b>Trees</b>	
<i>Populus fremontii</i>	Fremont Poplar
<i>Salix exigua</i>	Narrowleaf Willow
<i>Populus angustifolia</i>	Narrowleaf cottonwood
<i>Elaeagnus angustifolia</i>	Russian olive
<b>Shrubs</b>	
<i>Cercocarpus montanus</i>	Alderleaf mountain mahogany
<i>Artemisia tridentata</i> ssp. <i>tridentata</i>	Basin big sagebrush
<b>Grasses and Forbs</b>	
<i>Phalaris arundinacea</i>	Reed canarygrass
<i>Equisetum laevigatum</i>	Smooth horsetail
<i>Juncus balticus</i>	Black-tip needle rush

Plant names are from the NRCS Plants Database 2005.

### S.10.4.4 UNDESIRABLE PLANT SPECIES AND NOXIOUS WEEDS

The vegetation in sub-reaches C-F (200 East Bridge to Airport Road) of the project area consists largely of undesirable plant species and/or noxious weeds, with very few, if any, native species (Figure 3.8). Common weedy plant species in this association are shown in Table S.5.

**Table S.5.** Common Undesired Plant Species and Noxious Weeds Observed in the Project Area

Scientific Name	Common Name	Status
<i>Bromus tectorum</i>	Cheatgrass	Colorado State Noxious Weed
<i>Cardaria draba</i>	Whitetop (hoary cress)	Utah State Noxious Weed
<i>Carduus nutans</i>	Musk thistle	Utah State Noxious Weed
<i>Ceratocephala testiculata</i>	Curve seed butterwort	Undesired Plant Species
<i>Chorispora tenella</i>	Blue mustard	Colorado State Noxious Weed
<i>Cirsium arvense</i>	Canada thistle	Utah State Noxious Weed

**Table S.5.** Common Undesired Plant Species and Noxious Weeds Observed in the Project Area, continued

Scientific Name	Common Name	Status
<i>Descurania sophia</i>	Flixweed	Colorado State Noxious Weed
<i>Elaeagnus angustifolia</i>	Russian olive	Carbon, Duchesne, Uintah, Sevier, and Wayne County Noxious Weeds
<i>Euphorbia myrsinites</i>	Myrtle spurge	Undesired Plant Species
<i>Erodium cicutarium</i>	Redstem stork's bill	Undesired Plant Species
<i>Lepidium latifolium</i>	Tall whitetop (perennial pepperweed)	Utah State Noxious Weed
<i>Salsola tragus</i>	Prickly Russian thistle	Undesired Plant Species

Plant names are from NRCS 2004.

### **S.10.5 WETLAND AND RIPARIAN RESOURCES**

The project area was surveyed for wetlands and riparian resources on April 27 and 28, 2005. The project area is divided into three river reaches.

The upper reach extends from the eastern boundary of the project area to just southeast of Center Street (sub-reach A), where the creek's banks begin to be more channelized and confined with rocks on either bank, thereby causing the creek to lose its ability to meander. In general, the upper reach has more potential to support wetlands and riparian resources than do the middle and lower reaches. Along this reach, some bank stabilization work has been done, but less than the other two reaches considered. The natural floodplain is relatively undeveloped, and there are several off-channel areas primarily consisting of upland vegetation. At the very top of the reach, before the UP&L drop structure and just outside the project area, there is a scrub-shrub wetland on each side of the creek. Further downstream is a small wet meadow/scrub-shrub wetland on the south side of the creek; it is primarily influenced by a meander that rejoins the main channel downstream. The fourth wetland found within the upper reach is located at the base of a deeply incised bank on the south side of the creek, upstream of the Center Street Park. It is a small depressional wet meadow with a predominance of black-tip needle rush.

The middle reach is that portion that extends from southeast of Center Street to a point about 200 feet west of the Main Street Bridge (sub-reaches B, C, and the eastern portion of D, see Figure 2.3). Past channel modifications to straighten meanders, meet irrigation demands, control flooding, and adapt to growth demands have impacted the natural character of Coal Creek along this reach. These changes have decreased the potential for wetland and/or riparian areas to develop along the reach.

The lower reach extends from approximately 200 feet west of the Main Street Bridge described above to Airport Road, including sub-reaches E, F and the western portion of D (see Figure 2.4). This reach has few to no existing wetlands or riparian resources, either within the present channel, or along the sides of the bank. The channel is straight and is maintained as needed to remove sediment accumulation, creating levee-like mounds on both sides of the channel.

### **S.10.6 WILDLIFE RESOURCES**

Twenty-six Special Status species and three big game species that occur within Iron County were analyzed as to their potential to occur within the Coal Creek project area. Of the Special Status species, six are federally-listed by the USFWS, 19 are state-listed species, and one is a conservation species (Table S.6).

**Table S.6.** Special Status Species Known to Occur in Iron County and with Potential to Occur in the Coal Creek Project Area

<b>Common Name</b>	<b>Scientific Name</b>	<b>Status</b>	<b>Potential Impacts</b>	<b>Notes</b>
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	Yes	Bald eagles winter in the area and may roost in large trees by the creek.
California condor	<i>Gymnogyps californianus</i>	Exp	No	These birds are tracked closely by the USFWS and generally are not in the proximity of the proposed project. This species would not be an issue for this project.
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	C	Yes	UDWR does have a sighting of a cuckoo in the general vicinity of the project area, most likely a migrant. However, the yellow-billed cuckoo habitat within the project area is not high-quality.
Mexican spotted owl	<i>Strix occidentalis lucida</i>	T	Yes	The 1997 MSO model indicates there is habitat in the vicinity of the project area. No MSOs have been detected in the project area.

**Table S.6.** Special Status Species Known to Occur in Iron County and with Potential to Occur in the Coal Creek Project Area, continued

Common Name	Scientific Name	Status	Potential Impacts	Notes
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	E	Yes	The riparian habitat within the project area is not dense enough to constitute suitable southwestern willow flycatcher habitat. However, the riparian zone could serve as a temporary resting or foraging stopover for migrants.
Utah prairie dog	<i>Cynomys parvidens</i>	T	Yes	Utah prairie dogs do occur in the general vicinity of the project area.
Arizona toad	<i>Bufo microscaphus</i>	SPC	No	This toad is found in southern Utah, predominately in the Virgin River Basin. Habitat for the toad is not found in the project area.
Black swift	<i>Cypseloides niger</i>	SPC	No	In Utah and Colorado, this species is closely associated with waterfalls; it nests behind or in the spray of the waterfall. In Utah this species is only known from three breeding locations. It has been spotted in the general vicinity of the project area. However, there is no suitable black swift habitat in or near the project area.
Bonneville cutthroat trout	<i>Oncorhynchus clarki utah</i>	CS	No	This fish does not occur in Coal Creek or any downstream water bodies that Coal Creek flows into. Therefore, it would not be impacted by this project.
Brian head mountainsnail	<i>Oreohelix parawanensis</i>	SPC	No	This species occurs at a single locality in Iron County. They are not found near the project area, nor is there suitable habitat for them.
Burrowing owl	<i>Athene cunicularia</i>	SPC	Yes	This species breeds in burrows and is often associated with prairie dogs. Accordingly, it is possible that they occur in the project area.

**Table S.6.** Special Status Species Known to Occur in Iron County and with Potential to Occur in the Coal Creek Project Area, continued

Common Name	Scientific Name	Status	Potential Impacts	Notes
Common chuckwalla	<i>Sauromalus ater</i>	SPC	No	This species occurs in desert communities with large rocky areas on hillsides. Habitat for this species is not found in the project area.
Dark kangaroo mouse	<i>Microdipodops megacephalus</i>	SPC	No	This species occurs in sagebrush desert with fine, gravelly soil. Suitable sagebrush habitat for this species does not occur within the project area.
Ferruginous hawk	<i>Buteo regalis</i>	SPC	Yes	This species could potentially occur within the project area.
Fringed myotis	<i>Myotis thysanodes</i>	SPC	Yes	This species occurs in a variety of habitats, including desert scrub. It roosts in tunnels, caves and buildings. It is wide-ranging but quite rare in Utah. Potential habitat for this species is found in the project area.
Greater sage-grouse	<i>Centrocercus urophasianus</i>	SPC	No	This species occurs in sagebrush habitat. However, suitable sagebrush habitat for this species does not occur within the project area.
Kit fox	<i>Vulpes macrotis</i>	SPC	No	This species occurs in arid areas of the state with soils suitable for denning. This habitat is not found within the project area.
Least chub	<i>Notichthys phlegethontis</i>	SPC	No	This fish does not occur in Coal Creek and therefore would not be impacted by this project.

**Table S.6.** Special Status Species Known to Occur in Iron County and with Potential to Occur in the Coal Creek Project Area, continued

Common Name	Scientific Name	Status	Potential Impacts	Notes
Lewis's woodpecker	<i>Melanerpes lewis</i>	SPC	No	This species has been documented in the general vicinity of the project area (UDWR 2005). It is a habitat specialist, breeding in ponderosa pine near open riparian areas. The project area does not have this habitat type; therefore, this species would not be impacted by this project.
Long-billed curlew	<i>Numenius americanus</i>	SPC	No	This species nests in dry grasslands. This habitat is not found near the project area.
Northern goshawk	<i>Accipiter gentilis</i>	SPC	No	There is no habitat for this species within the project area. However, there is potential habitat in the surrounding area, and a goshawk has been spotted within the vicinity of the project area (USFS Unpublished). Nonetheless, as development would be restricted to the project area, this species would not be impacted by this project.
Pygmy rabbit	<i>Brachylagus idahoensis</i>	SPC	No	This species is a sagebrush obligate and occurs in areas with deep soils and tall, dense sagebrush. They have been detected in the general vicinity of the project area (Durrant 1952). However, suitable sagebrush habitat for this species does not occur within the project area. Therefore, this species would not be impacted by this project.
Short-eared owl	<i>Asio flammeus</i>	SPC	No	This is an open-country, ground-nesting species that occupies grassland and tundra. These habitats are not found within the project area.

**Table S.6.** Special Status Species Known to Occur in Iron County and with Potential to Occur in the Coal Creek Project Area, continued

Common Name	Scientific Name	Status	Potential Impacts	Notes
Spotted bat	<i>Euderma maculatum</i>	SPC	Yes	This species often occurs in dry desert terrain. Roosts are typically in rock crevices or under loose rocks. Roosts of this type may occur in the project area. This species has been detected in the general vicinity of the project area (Toone 1991).
Three-toed woodpecker	<i>Picoides tridactylus</i>	SPC	No	This species prefers high-elevation conifer forests. There is no suitable habitat for this species within the project area.
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	SPC	Yes	Suitable habitat for this species is typically associated with the caves and abandoned mines. Potential habitat may exist in the project area.

T = Federally Threatened  
 E = Federally Endangered  
 C = Federal Candidate  
 Exp = Federal Experimental Population  
 SPC = State Sensitive Species  
 CS = Conservation Species

Those wildlife species that are not Special Status species are discussed under the followed general categories: big game species (i.e., mule deer, black bear, and mountain lion); upland game; raptors; reptiles; amphibians; and non-game species (i.e., riparian and aquatic species and migratory birds).

### **S.10.6.1 BIG GAME SPECIES**

#### **S.10.6.1.1 MULE DEER**

Mule deer (*Odocoileus hemionus*) occupy most ecosystems in Utah but likely attain their greatest densities in shrublands or other areas characterized by rough, broken terrain and abundant browse and cover. Mule deer summer range habitat types include spruce/fir, aspen, alpine meadows, and large grassy parks located at higher elevations. Winter range habitat primarily consists of shrub-covered; south facing slopes and often coincides with areas of concentrated human use and occupation. For this reason, winter range is often considered a limiting factor for mule deer in the Intermountain West (Robinette 1966). The project area, according to the UDWR, falls within mule deer critical winter habitat (UDWR 2005).

#### **S.10.6.1.2 BLACK BEAR**

In the Intermountain West, black bears (*Ursus americanus*) are typically associated with forested or brushy mountain environments and wooded riparian corridors and seldom use open habitats (Zeveloff and Collett 1988). Black bears tend to be nocturnal, crepuscular, and omnivorous. According to UDWR data, the entire project area falls within high-value, year-long, black bear habitat. However, actual black bear habitat within the project area is most likely found only upstream of the mouth of Cedar Canyon.

#### **S.10.6.1.3 MOUNTAIN LION (COUGAR)**

The mountain lion or cougar (*Felis concolor*), likely inhabits most ecosystems in Utah. However, it is most common in the rough, broken terrain of foothills and canyons, often in association with montane forests, shrublands, and pinyon-juniper woodlands (Fitzgerald et al. 1994). Mule deer is the mountain lion's preferred prey species. Consequently, mountain lion seasonal use ranges generally closely parallel those described above for mule deer. Mountain lions have been observed in the vicinity of the project area (personal communication with Martin Tyner, Southwest Wildlife Foundation, April 2005).

#### **S.10.6.2 UPLAND GAME**

Upland game in the project area includes potential habitat for species such as the Rio Grande turkey (*Meleagris gallopavo*), ring-necked pheasant (*Phasianus colchicus*) and band-tailed pigeon (*Columba fasciata*), to name a few. The project area falls within summer high-value habitat southeast of the mouth of Cedar Canyon for the band-tailed pigeon.

#### **S.10.6.3 RAPTORS**

Special habitat needs for raptors include nest sites, foraging areas, and roosting or resting sites. Raptor surveys were completed in the Coal Creek project area by SWCA on May 3, 2005. No nests (active or non-active) were detected within the project area. However, there is one peregrine falcon (*Falco peregrinus*) eyrie in the project vicinity, which may have been active in 2005 (personal communication with Martin Tyner, Southwest Wildlife Foundation, April 2005; see Figure 3.9)

#### **S.10.6.4 REPTILES, AMPHIBIANS, AND OTHER NON-GAME SPECIES**

The various riparian and pinyon-juniper habitats in the project area are used by a high diversity of reptile, amphibian, and other non-game species, including small mammals, birds, and invertebrates. Very little is known about the status of most of these species in the project area. However, it can be ascertained that the little riparian habitat currently left on Coal Creek would provide some of the most productive habitat for these species in the project area.

### S.10.6.5 MIGRATORY BIRDS

Numerous species of neo-tropical migratory birds can be found utilizing various habitats within and around the project area at different times of the year. The riparian areas are potentially the most useful areas for nesting, roosting, and foraging and may show the greatest diversity of species. Some of the more common and visible birds within the project area include raptors such as red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), prairie falcon (*Falco mexicanus*), American kestrel (*Falco sparverius*), and great-horned owl (*Bubo virginianus*). Neo-tropical migratory birds that could potentially inhabit the project area include sage sparrow (*Amphispiza belli*), blue-gray gnatcatcher (*Polioptila caerulea*), western kingbird (*Tyrannus verticalis*), Virginia's warbler (*Vermivora virginiae*), black-chinned hummingbird (*Archilochus alexandri*), black-throated gray warbler (*Dendroica nigrescens*), gray vireo (*Vireo vicinior*), green-tailed towhee (*Pipilo chlorurus*), Say's phoebe (*Sayornis saya*), savannah sparrow (*Passerculus sandwichensis*), vesper sparrow (*Pooecetes gramineus*), black-throated sparrow (*Amphispiza bilineata*), gray flycatcher (*Empidonax wrightii*), Cassin's kingbird (*Tyrannus vociferans*), and white-throated swift (*Aeronautes saxatalis*).

### S.10.7 CULTURAL RESOURCES

In order to identify cultural resources that are present within the Coal Creek Parkway APE and to assess the potential impacts of the project alternatives on these properties, intensive-level pedestrian cultural resources inventories were conducted within the majority of the APE (Christensen et al. 2005; Tews and Stokes 2006). An additional assessment that did not require field inspection was also conducted (Ellis 2006). These inventories and assessment resulted in the identification of 19 cultural resource sites that are located within the APE (Table 3.14).

**Table S.7.** Cultural Resource Sites in the Coal Creek Parkway Area of Potential Effect (APE)

Site Number	Site Type	Site Name	NRHP Site Eligibility
N/A	Truss Bridge	Historic 200 North (Pedestrian) Bridge/UDOT Structure Number 021013C	Eligible
N/A	Iron Mill	Pioneer Iron Works Utah State Historic Site	Eligible
42IN1221	Historical Flour and Plaster Mill	Cedar Co-op Flour Mill/Plaster Mill	Not Eligible
42IN1224	Historic CCC Water Control Feature (South Fields Diversion)	N/A	Eligible
42IN1225	Historical Power Plant	SUP Power Plant	Not Eligible

**Table S.7.** Cultural Resource Sites in the Coal Creek Parkway Area of Potential Effect (APE), continued

Site Number	Site Type	Site Name	NRHP Site Eligibility
42IN1226	Historic CCC Water Control Feature (UP&L drop structure)	N/A	Eligible
42IN2273	Prehistoric Lithic Scatter	N/A	Not Eligible
42IN2274	Historical USGS Gauging Station	N/A	Not Eligible
42IN2275	Historic Irrigation Diversion Structure	Main Street Diversion	Eligible
42IN2276	Historical Trash Scatter	N/A	Not Eligible
42IN2277	Historic Farmstead	N/A	Eligible
42IN2278	Historical Water Control Feature	N/A	Not Eligible
42IN2279	Historical Bridge	N/A	Not Eligible
42IN2280	Historical Stream Diversion Structure	Woodbury Diversion	Not Eligible
42IN2281	Historical Irrigation Canal	Old Fort/Old Field Canal	Not Eligible
42IN2282	Historic Irrigation Canal	North West Field Canal	Eligible
42IN2283	Historic Irrigation Canal	North Field/East Extension Canal	Eligible
42IN2284	Historic Irrigation Canal	Union Field Canal	Eligible
42IN2285	Historic Bridge	Main Street Bridge/UDOT Structure Number OD546	Eligible

### **S.10.8 RECREATION AND VISUAL RESOURCES**

Recreation and tourism have become two of Utah's largest economic sectors. In 2003, over 17 million domestic and international travelers visited the state, spending an estimated \$4.3 billion. Approximately 2 million of these visitors traveled through Iron County in 2003 (Cedar City 2005a). Businesses supporting these visitors accounted for over 100,000 jobs statewide, or roughly 10% of all non-agricultural jobs in the state.

Cedar City and its surrounding area have played a major role in attracting visitors to Utah. With an average of 310 days of clear skies per year and an average annual temperature of 50.5°F, and surrounded by Zion and Bryce Canyon National Parks, Cedar Breaks National Monument, and many other natural attractions, the area offers unparalleled natural and aesthetic beauty, earning Cedar City its nickname of the "Gateway to the Parks." The unique

visual and recreational resources of the lands surrounding the City provide a variety of opportunities, such as hiking, wildlife viewing, climbing, mountain biking, fishing, and various other activities, for millions of people each year (Cedar City 2005a; Table S.8).

**Table S.8.** Regional Visitation Counts in 2003

Park/Monument	Visitors
Zion National Park	2,480,690
Bryce Canyon National Park	1,375,115
Grand Staircase-Escalante National Monument	670,000
Quail Creek State Park	663,390
Cedar Breaks National Monument	605,930
Snow Canyon State Park	347,804
Kolob Canyons	189,228
Brian Head Ski Resort	145,000
Iron Mission State Park	18,882
Total	6,496,039

Source: Cedar City-Brian Head Tourism & Convention Bureau.

The winter months bring nearly 145,000 skiers and snowboarders to Brian Head Resort, which is 30 minutes north of Cedar City. *Family Travel Forum* recently selected Brian Head as one of the top 10 getaways for the family due to its affordability and quality year-round entertainment (Cedar City 2005a). Summer months at Brian Head provide opportunities for world-class mountain biking, OHV riding, hiking, and various other activities. Approximately 65% of the resort's guests arrive via from Las Vegas and Southern California, necessitating the need for accommodation and entertainment in town (Cedar City 2005a).

Cedar City is the cultural center and county seat of Iron County and has the largest population by far (23,838, as of the 2000 Census; U.S. Bureau of Census 2000), more than double the remaining population within the county. Iron County has many cultural, civic, and commercial facilities for use by its citizens as well as patrons traveling to or through Cedar City. As the population and regional demand increases these amenities will no doubt change in number increase. Although such facilities are spread throughout the county, many are located within Cedar City (Table S.9).

**Table S.9.** Cedar City Facilities Commonly Used for Recreation

Facility Type	Number
Equestrian Center	1
Golf	1
Art Galleries	2
ATV Rentals	3
Movie Theaters	3
Libraries	3
Rodeo Grounds	4
Museums	4
Radio Stations	5
Professional/Amateur Theaters	5
Bars/Pubs/Lounges	7
Parks	8
Tennis Courts	10
Ball Fields	12
Eating Establishments	56
Hotel Rooms	1,583

Source: Iron County Tourism and Convention Bureau.

**S.10.9 SOCIOECONOMIC AND ENVIRONMENTAL JUSTICE**

Socioeconomics typically can be discussed in terms of the social setting, the economic setting, and the relationship between the two. A social and economic analysis traditionally involves gathering relevant and available data to prepare a report describing the socioeconomic characteristics of a given area.

The ethnicity of Cedar City is fairly homogenous. More than 90% of City residents are white. The Hispanic ethnicity comprises only 4% of the remaining population. As might be expected in a city so close to numerous Tribal lands, the next largest ethnic group in Cedar City is Native Americans, though only at 2.5% (Table S.10).

Today Cedar City has a healthy, diverse economy comprising four major sectors: Manufacturing (28%), Retail Trade (28%), Accommodations and Food Services (20%), and Administrative Services and Support (13%). Due to its centralized location to other major markets in the West, its proximity to various regional transportation options (including I-15, the Union Pacific Railroad, and the Cedar City Regional Airport), and the commitment of local

**Table S.10.** Total Population by Race

	Population	Percent
White/Caucasian	18,897	92.1%
Hispanic/Latino	841	4.1%
American Indian or Alaska Native	519	2.5%
Asian	227	1.1%
Black/African American	97	0.5%
Native Hawaiian or Other Pacific Islander	67	0.3%
Other race	339	1.7%
Two or more races	381	1.9%

Source: Sonoran Institute 2005.

government leaders, Cedar City has successfully attracted a diversified manufacturing base (Cedar City 2005a). Today, more than 15 manufacturing firms call Cedar City home, creating products such as plastic molding and aircraft parts. Three industrial parks with easy access to I-15 house a variety of distributors and manufacturers. The centralized location of the City makes it accessible to 86.5% of the Western metropolitan population—within a single day's trucking (Cedar City 2005a).

Southern Utah University (SUU) is located in Cedar City as well. Founded in 1897 as a teacher-training school, SUU is now a four-year university with a variety of undergraduate- and graduate-level curricula providing the higher learning needs for individuals in the region. Today nearly 7,000 students attend the university, with faculty and staff numbering 650.

#### ***S.10.10 NATIONAL ECONOMIC DEVELOPMENT (NED) ANALYSIS***

National economic development (NED) accounting is conducted in order to analyze whether alternatives for a proposed, federally funded water resource project, if implemented, would be beneficial to the national economy as a whole, from the standpoint of market-valued benefits and costs. Once NED accounting is completed for a given project, the alternative found to maximize net economic benefits at the national level is designated as the NED Alternative.

There are different approaches to NED accounting and associated benefit-cost analysis. The process used in the Coal Creek EIS follows a standard benefit-cost analysis approach, using present net value for all public and private benefits and costs. The same analysis is used for each Coal Creek alternative under consideration.

Analysis shows that the objectives of the Coal Creek project (i.e., to reduce flood damages and to enhance the recreational experience along the parkway) would be met by reducing the size of the 100-year and 500-year floodplains (and thus reducing the potential for flood damages) and by increasing the number of recreation users along the parkway as well as the overall recreation experience at the parkway (based on survey responses), respectively. Additional detail regarding the Coal Creek NED analysis can be found in Appendix D.

## **S.11 ENVIRONMENTAL CONSEQUENCES**

Chapter 3 of this Final EIS provides a comprehensive scientific and analytical comparison of the potential environmental consequences for alternatives A through C. These potential impacts are summarized in Table 2.1 at the end of Chapter 2 of this Final EIS.